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Sustainable development: promotion of new and renewable sources of energy

Promotion of new and renewable sources of energy

Report of the Secretary-General

Summary

New and renewable sources of energy are at the centre of global efforts to induce a paradigm shift towards green economies, poverty eradication and, ultimately, sustainable development. Record investments continue being made by some countries to propel the innovation, development and commercialization of renewable energy technologies. Nevertheless, the international economic crisis and changing policy environments in some countries are creating new uncertainties and challenges when enhanced cooperation and action are needed to increase substantially the contribution of these technologies to the global energy system. In 2011 and 2012, however, there has been promising renewed interest in renewable energy, resulting from the initiative of the Secretary-General "Sustainable Energy for All". The remarkable national, regional and global commitments announced during the past two years, including at the United Nations Conference on Sustainable Development held in June 2012, demonstrate the effectiveness of this initiative in the promotion of new and renewable sources of energy.

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I. Introduction

1. The General Assembly, in its resolution 62/197, reaffirmed the need for putting into action the full Plan of Implementation of the World Summit on Sustainable Development ("Johannesburg Plan of Implementation")[1] as the intergovernmental framework for energy for sustainable development. The Johannesburg Plan of Implementation calls for action at all levels to, with a sense of urgency, substantially increase the global share of renewable energy sources with the objective of increasing its contribution to total energy supply.[2] The Assembly encouraged the United Nations system to continue to raise awareness of the importance of energy for sustainable development, including the need for the promotion of new and renewable sources of energy and the increased role they can play in the global energy supply, particularly in the context of sustainable development and poverty eradication.

2. By the same resolution, the Assembly welcomed initiatives that aim to improve access to reliable, affordable, economically viable, socially acceptable and environmentally sound energy services for sustainable development in order to contribute to the achievement of internationally agreed development goals, including the Millennium Development Goals. In addition, the Assembly recognized the contributions of new and renewable sources of energy to reducing greenhouse gases and addressing climate change, and called upon the international community to support the least developed countries, the landlocked developing countries and the small island developing States in their efforts to develop and utilize energy resources, including new and renewable energy.

3. By resolution 65/151, the Assembly decided to declare 2012 the International Year of Sustainable Energy for All. In pursuance of that decision, initiatives are being undertaken by Member States and international organizations to create at all levels an enabling environment for the promotion of access to energy and energy services and the use of new and renewable energy technologies.

4. The present report is submitted in response to General Assembly resolution 66/206, in which the Assembly requested the Secretary-General to submit to it at its sixty-seventh session a report on the promotion of new and renewable sources of energy. In the same resolution, the Assembly invited Member States, as well as the United Nations system and all other relevant stakeholders, to use the opportunity offered by the International Year to raise global awareness of the importance of new and renewable sources of energy and low-emission technologies, the more efficient use of energy, greater reliance on advanced energy technologies, including cleaner fossil fuel technologies, and the environment-friendly use of traditional energy resources, as well as the promotion of access to modern, reliable, affordable and sustainable energy services, and noted in that regard the initiative of the Secretary-General "Sustainable Energy for All".

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[1] *Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002* (United Nations publication, Sales No. E.03.II.A.1 and corrigendum), chap. I, resolution 2, annex.

[2] Ibid., paragraph 20 (e).

II. Overview of new and renewable sources of energy

A. Status

5. The role of renewable energy in global energy supply continues to increase in some regions of the world. The trends of the past decade reflect strong growth in all energy sectors, including power generation, heating and cooling, and transport fuels. Nevertheless, the overall contribution of new and renewable sources of energy to the global energy system remains limited, and the outlook is clouded by the uncertainties resulting from the international financial crisis and declining political support in some countries.

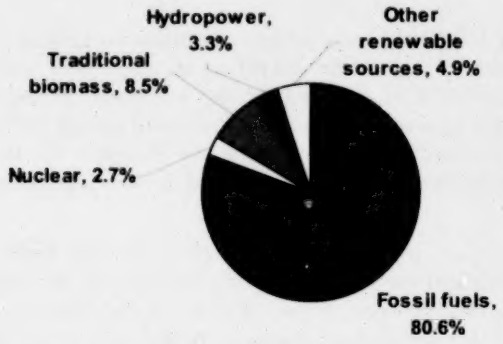
6. Recent events, such as the impact of the natural disasters at the Fukushima nuclear plant in Japan in 2011, highlight the importance of continuing to develop cost-competitive new and renewable sources of energy. In many countries, policymakers and the public and private sectors continue to be supportive of national strategies to accelerate the deployment of renewable energy technologies and to expand their corresponding markets. At the global level, the initiative of the Secretary-General "Sustainable Energy for All" and the declaration by the General Assembly of 2012 as the International Year of Sustainable Energy for All have sparked the announcement of significant commitments on actions that provide strong support for the increased use of new and renewable energy sources. These efforts are key to sustaining the transformation of energy systems and to fuelling the green economies of the future.

7. Figure I shows the shares of various fuels in global final energy consumption in 2011. The total share of renewable energy sources in energy consumption is 16.7 per cent. Of all renewable energy sources, traditional biomass still has the largest share, at 8.5 per cent, followed by hydropower at 3.3 per cent. Other renewable energy sources, with a total share of 4.9 per cent, include wind, solar, geothermal, modern biomass and biofuels.

8. Traditional biomass is solid biomass used in an unsustainable manner and includes fuelwood, agricultural waste and animal dung. It usually represents the only fuel available or affordable to the poor in many developing regions. Worldwide, about 2.7 billion people continue to depend on traditional biomass for cooking, 84 per cent of whom live in rural areas.[3] The use of traditional biomass and lack of ventilation in households in developing countries are associated with very high levels of pollutants, such as particulates, carbon monoxide and formaldehyde. Women and young children represent the segments of the population with the highest exposure to these pollutants.

[3] Organization for Economic Cooperation and Development (OECD)/International Energy Agency (IEA), *World Energy Outlook 2011* (Paris, 2011).

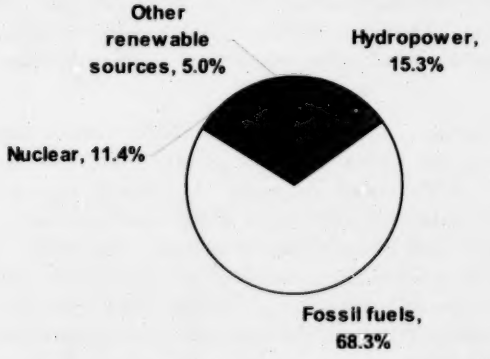
Figure I
Fuel shares in global final energy consumption, 2011



Source: Renewable Energy Policy Network for the 21st Century (REN21), *Renewables 2012: Global Status Report* (Paris, REN21 Secretariat, 2012).

9. Figure II shows fuel shares in global electricity generation for 2011. Renewable energy sources generated about 20 per cent of the electricity worldwide in 2011, with hydropower providing about 15 per cent. Other renewable sources generated 5 per cent of global electricity in 2011.

Figure II
Fuel shares in global electricity generation, 2011

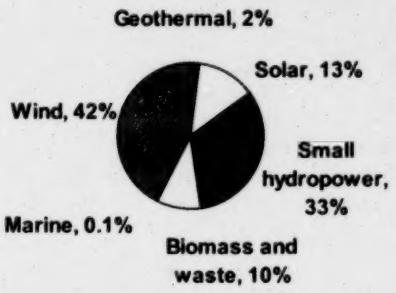


Source: *Renewables 2012: Global Status Report* (see fig. I). Data on nuclear share are from World Nuclear Association, "Nuclear share figures, 2001-2011" (London, April 2012).

10. In terms of power capacity, renewable sources comprise more than 25 per cent of the total global power-generating capacity, estimated at 5,360 gigawatts (GW) in 2011. Figure III shows shares of global renewable electric power capacity. The shares of renewable fuel sources consider only small hydropower plants (between

1 and 50 megawatts).[4] Wind has the largest capacity share at 42 per cent, followed by small hydropower at 33 per cent and solar at 13 per cent.

Figure III
Shares of global renewable electric power capacity, 2011



Source: The Pew Charitable Trusts, *Who's Winning the Clean Energy Race? 2011 Edition* (Philadelphia, Pennsylvania, 12 April 2012).
Note: Data exclude large hydropower and consider only small hydropower (between 1 and 50 megawatts).

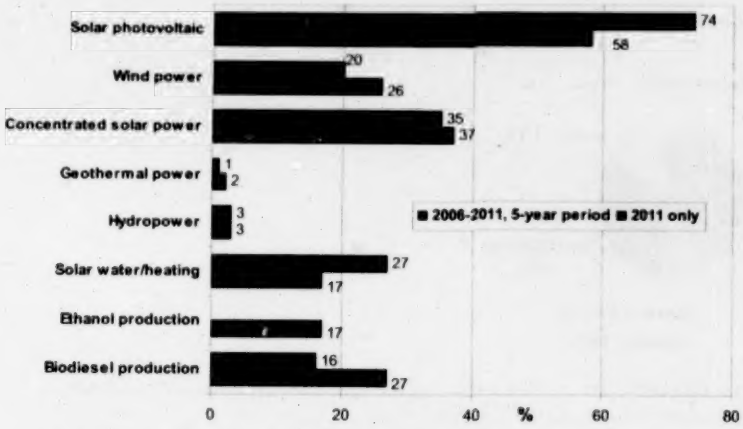
11. The average annual growth rate of renewable energy capacity and biofuel production for the period 2006-2011 and for 2011 only is illustrated in figure IV. Most new and renewable sources of energy grew at an accelerated pace during 2006-2011. In 2011, solar capacity experienced the fastest growth, with 74 per cent for solar photovoltaic, 35 per cent for concentrated solar power and 27 per cent for solar hot water/heating.

12. Solar photovoltaic was the fastest growing renewable energy technology worldwide from 2000 to 2011, with an average annual growth of over 40 per cent. The growth was mainly in a few developed markets such as Germany, Italy, the United States of America and Japan.[5] Regions with good solar potential, such as Africa and parts of Asia, could add significant solar capacity.

[4] Some references consider small hydropower plants to be those with a capacity of less than 10 megawatts.

[5] OECD/IEA, *Tracking Clean Energy Progress: Energy Technology Perspectives 2012 Excerpt as IEA input to the Clean Energy Ministerial* (Paris, 2012). Available from www.iea.org/papers/2012/Tracking_Clean_Energy_Progress.pdf.

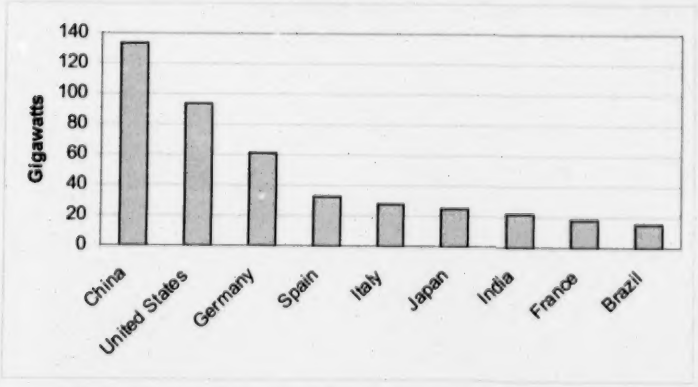
Figure IV
Average annual growth rate of renewable energy capacity and biofuel production, 2006-2011 and 2011



Source: *Renewables 2012: Global Status Report* (see fig. I).

13. China is leading the world in installed new renewable energy capacity, followed by the United States of America (see fig. V).[6] Other developing countries which have relatively large capacities include Brazil and India. In addition, China also has been leading in terms of growth in the past five years, followed by Turkey, Brazil, Italy and Argentina. The industry is being supported in these countries by accelerated private investment, consistent and stable government energy policies and advances in technology that are being translated into cost reductions.

Figure V
Countries with largest installed new renewable energy capacity by 2011



Source: *Who's Winning the Clean Energy Race? 2011 Edition* (see fig. III).
Note: Data for hydropower are for plants with capacities between 1 and 50 megawatts.

[6] The Pew Charitable Trusts, *Who's winning the Clean Energy Race? 2011 Edition* (Philadelphia, Pennsylvania, 2012).

14. Cost estimate comparisons of energy technologies vary considerably and depend on many factors and assumptions that affect the calculations. In 2011, REN21 published costs for renewable energy technologies from a variety of sources, including IEA, the National Renewable Energy Laboratory in the United States of America and the World Bank (see table 1). These costs are economic costs, exclusive of subsidies or policy incentives.

15. The costs of some renewable energy technologies are now competitive with the costs of conventional energy technologies which are generally estimated to be between 4 and 10 cents per kilowatt hour.[7] Onshore wind, biomass and geothermal for power generation are becoming competitive in some world regions. Biomass, some solar and geothermal are also competitive for hot water and heating, as is ethanol for transportation. Most alternatives for off-grid applications in rural areas are still too expensive. The high costs of these technologies, in addition to other important development and transfer barriers, indicate the need for more support for the promotion of renewable energy in developing countries.

Table 1
Costs of renewable energy technologies

Technology	*Typical characteristic*	*Typical energy cost (United States cents)*	*Comment*
Power generation (cost per kWh)			
Large hydropower	10-18,000 (MW)	3-5	Currently one of the lowest-cost energy technologies
Small hydropower	1-10 MW	5-12	
Onshore wind	1.5-3.5 MW	5-9	Blade diameter: 60-100 metres
Offshore wind	1.5-5 MW	10-20	Blade diameter: 70-125 metres
Biomass	1-20 MW	5-12	
Geothermal	1-100 MW	4-7	Types: binary, single- and double-flash, natural steam
Rooftop solar photovoltaic	2-5 kW-peak capacity	17-34	
	200 kW to 100 MW	15-30	
Concentrated solar power	50-500 MW (trough) 10-20 MW (tower)	14-18	Costs for trough plants; costs decrease as plant size increases; a rapidly maturing technology
Hot water/heating (cost per kWh)			
Biomass heat	1-20 MW	1-6	Most cost-competitive renewable energy technology for heating

[7] REN21, *Renewable Energy Potentials in Large Economies — Summary Report: Opportunities for the Rapid Deployment of Renewable Energy in Large Economies, its Impacts on Sustainable Development and Appropriate Policies to Achieve It* (Paris, 2008); and Intergovernmental Panel on Climate Change, 2011, *Special Report on Renewable Energy Sources and Climate Change Mitigation* (available from http://srren.ipcc-wg3.de/report).

Technology	*Typical characteristic*	*Typical energy cost (United States cents)*	*Comment*
Solar	2-5m^2 (household)	2-20	Household, medium and large
	20-200m^2 (medium/ multi-family)	1-15	Types: evacuated tube, flat-plate
	0.5-2 MWth (large/district heating)	1-8	
Geothermal	1-10 MW	0.5-2	Applied for heating and cooling; types: heat pumps, direct use, chillers
Biofuels (cost per litre)			
Ethanol	Sugar cane, sugar beets, corn, cassava, wheat	30-50 (sugar)	Gasoline equivalent
	Sorghum (and cellulose in future)	60-80 (corn)	Gasoline equivalent
Biodiesel	Soy, rapeseed, mustard seed, jatropha, palm, waste vegetable oils	40-80	Diesel equivalent
Rural (off-grid) energy (cost per kW)			
Mini hydropower	100-1,000 kW	5-12	
Micro hydropower	1-100 kW	7-30	
Pico hydropower	0.1-1 kW	20-40	
Biogas gasifier	20-5,000 kW	8-12	
Household wind turbine	0.1-3 kW	15-35	
Village-scale mini grid	10-1,000 kW	25-100	
Solar home system	20-100 watts	40-60	

Source: REN21, *Renewables 2011: Global Status Report* (Paris, REN21 Secretariat, 2011).
Abbreviations: kW, kilowatt; kWh, kilowatt hour; MW, megawatt; MWth, megawatt thermal.

16. Nevertheless, technological improvements and innovation are allowing a rapid downward trend in the costs of most renewable energy technologies. Significant cost reductions have been achieved in the past decades, particularly for onshore wind (27 per cent) and solar photovoltaic (42 per cent).[8] The prices of solar photovoltaic modules per megawatt have fallen 60 per cent since 2008.[9] In some countries, solar has been reported to be competitive with other options in electricity retail prices. Wind turbine prices are also down 18 per cent since 2008. The expectation is that this trend will continue.

[8] OECD/IEA, *Tracking Clean Energy Progress: Energy Technology Perspectives 2012 Excerpt as IEA input to the Clean Energy Ministerial.*

[9] United Nations Environment Programme (UNEP) and Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment 2011* (June, 2011). Available from www.unep.org/pdf/BNEF_global_trends_in_renewable_energy_investment_2011_report.pdf.

17. Technological innovations are anticipated in regard to concentrated solar power and photovoltaic technologies and related manufacturing processes, enhanced geothermal systems, multiple emerging ocean technologies, advanced biofuels and biorefining, and foundation and turbine designs for offshore wind energy.[10]

18. The use of renewable energy provides many benefits that support the achievement of the universal and national goals for sustainable development. The carefully designed and integrated use of renewable energy technologies can, for example, create jobs, increase energy security, improve human health, enhance environmental protection and mitigate climate change.[11] Renewable energy technologies can also be used in climate change adaptation processes.

19. Globally, it is estimated that there are about 5 million direct or indirect jobs in renewable energy industries.[12] In 2009 and 2010, about 1 million jobs were created by the industry.[13] Figure VI shows the estimated jobs in renewable energy worldwide by industry in 2011. The industry with the largest number of jobs is biofuels, with about 1.5 million, followed by solar heating/cooling and solar photovoltaic. Although the total number of renewable energy jobs continued to increase through 2011, some countries are experiencing a decrease in the rate of growth or actual job losses as in the case of Spain.

20. Another important area of extreme importance for sustainable development is water. Renewable energy technologies using dry-cooling are not as vulnerable as conventional water-cooled thermal power plants (including nuclear plants) to conditions of water scarcity and climate change. The management of water resources represents a very important issue in sustainable development.

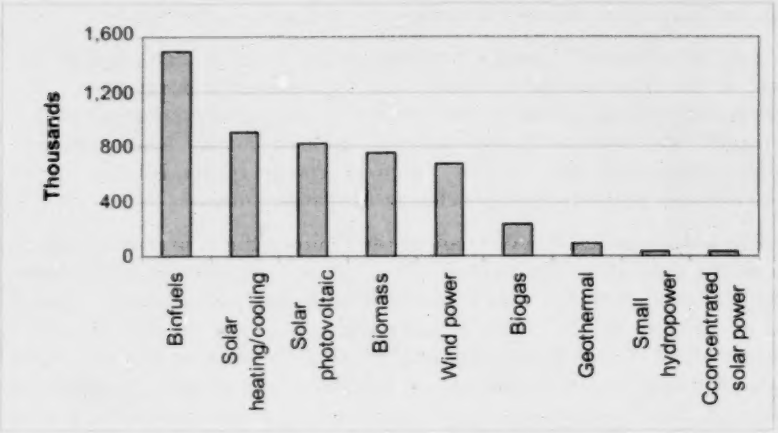
[10] Intergovernmental Panel on Climate Change, 2011, *Special Report on Renewable Energy Sources and Climate Change Mitigation*.

[11] International Institute for Applied Systems Analysis (IIASA), *Global Energy Assessment: Toward a Sustainable Future* (Cambridge, Cambridge University Press, 2012). Available in October 2012.

[12] REN21. *Renewables 2012: Global Status Report* (Paris, REN21 Secretariat, 2012). Available from www.map.ren21.net/GSR/GSR2012.pdf.

[13] Ibid.

Figure VI
Estimated jobs in renewable energy worldwide by industry, 2011



Source: *Renewables 2012: Global Status Report* (see fig. I).

21. There are still major, challenging economic and technological factors that affect the large-scale deployment of renewable energy, including: (a) reducing costs through learning and scale-up; (b) creating a flexible investment environment; (c) integrating renewable energy technologies into energy systems; (d) enhancing research and development; and (e) assuring the sustainability of the renewable energy technologies.[14]

22. Currently, renewable energy markets are experiencing significant changes due to the world economic crisis and the subsidy reductions in some key markets. The upheaval process is characterized by the restructuring and geographical shifting of supply chains. The current situation reflects a transition from support-driven markets to new and potentially more competitive markets.

23. In addition, recent drops in oil prices and increasing fossil fuel reserves in some regions, in particular of gas and oil resources, are starting to affect the competitiveness of renewable energy technologies. The perceived increase in the availability of fossil fuels is expected to affect the long-term scenarios that project a more active role and larger share of renewable energy in global energy supply.

B. Investments

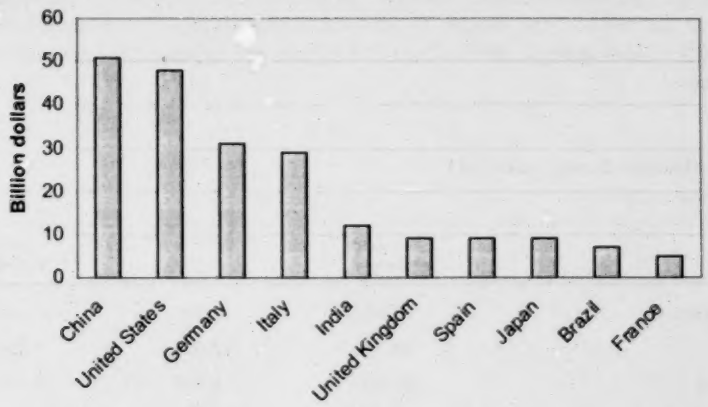
24. Global financing in the renewable energy sector in 2011 amounted to a record $257 billion.[15] This represents an increase of 17 per cent over 2010, with developing countries accounting for 35 per cent of total investment. Countries members of OECD and large emerging economies such as China, India and Brazil, are now the leaders, with record investments. Figure VII shows the top countries in new investment in clean energy in 2011. Figure VIII shows the global new

[14] IIASA, *Global Energy Assessment: Toward a Sustainable Future*.

[15] UNEP and Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment 2011*.

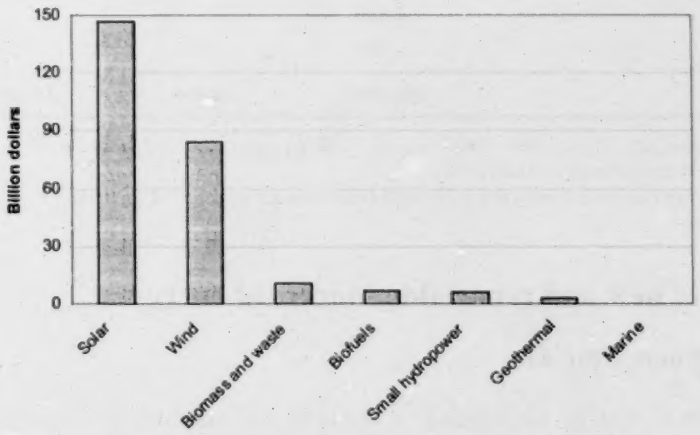
investment in renewable energy by sector in 2011. The largest investments were in solar power ($147 billion), followed by investments in wind ($84 billion).

Figure VII
Top countries in clean energy investment, 2011
(Billions of United States dollars)



Source: UNEP and Bloomberg New Energy Finance, *Global Trends in Renewable Energy Investment 2011* (June, 2011).

Figure VIII
Global new investment in renewable energy by sector, 2011
(Billions of United States dollars)



Source: *Global Trends in Renewable Energy Investment 2011* (see fig. VII).

25. Countries are following different strategies in their investments. The United States has the highest investment in venture capital, which is directed to the early stage of the technology development cycle with the objective of capitalizing later.

Europe has concentrated on stimulus for demand using regulatory policies such as feed-in tariffs to meet targets which promote renewable electricity generation. Asia is trying to capture the supply chain of technologies such as photovoltaic modules and wind turbines.

26. During the global crisis of 2008 and 2009, members of the Group of Twenty established stimulus funds of over $194 billion, which had long-term strategic significance for green growth and the clean energy sector. Table 2 presents the status of these funds at the end of 2011. About 73 per cent of the stimulus funds have been spent, with $46.3 billion spent in 2011. Over $53 billion are expected to be spent in the next few years.

Table 2
Clean energy stimulus funds, end-2011
(Millions of United States dollars)

Country	*Total announced*	*Spent in 2011*	*Total remaining*
United States of America	65 600	15 700	23 600
China	46 200	12 000	2 200
Republic of Korea	32 400	6 300	15 800
Germany	15 100	6 200	2
Other European Union	11 100	2 600	5 300
Japan	10 500	1 400	100
Australia	3 900	8	2 200
United Kingdom of Great Britain and Northern Ireland	3 400	1 400	800
Brazil	2 400	–	2 300
France	2 100	–	–
Canada	600	500	–
Total	**194 000**	**46 300**	**53 200**

Source: The Pew Charitable Trusts, *Who's Winning the Clean Energy Race? 2011 Edition* (Philadelphia, Pennsylvania, 12 April 2012).
Note: Members of the European Union not profiled individually are aggregated as "Other European Union".

III. Promotion of new and renewable sources of energy

A. Sustainable Energy for All

27. In September 2011 at the opening of the General Assembly's sixty-sixth session, the Secretary-General launched the Sustainable Energy for All initiative, which seeks to identify and mobilize action by all stakeholders in support of energy access, energy efficiency and increasing the share of renewable energy. At the same time, the Assembly declared 2012 the International Year of Sustainable Energy for All, recognizing the importance and urgency of energy challenges.

28. On 1 November 2011, the Secretary-General presented his vision statement, "Sustainable Energy for All" (A/66/645), which presents the case for change and defines the goal of achieving sustainable energy for all by the year 2030. This initiative of the Secretary-General has three specific objectives which underpin the goal of achieving sustainable energy for all: (a) ensuring universal access to modern energy services; (b) doubling the rate of improvement in energy efficiency; and (c) doubling the share of renewable energy in the global energy mix. By July 2012, the set of actions taken for the implementation of the initiative had proved it to be one of the most effective mechanisms currently in place at a global scale for the promotion of new and renewable sources of energy.

29. The vision statement of the Secretary-General was followed by the creation of the High-level Group on Sustainable Energy for All. The implementation plan for the initiative included the development of a framework for action and a communication strategy and plan, and the creation of task forces assigned to assess the three major objectives of the initiative. The framework for action identified the value of participation for each major stakeholder group, the benefits of stakeholder collaboration, the structure of the commitment process and the guiding principles of the initiative. Several high-level meetings and conferences were convened during the last quarter of 2011 and the first half of 2012, which resulted in the expression of major support for this initiative all over the world.

30. In April 2012, the global action agenda was launched. The agenda provides a strategy for engagement by Governments, the private sector and civil society. The agenda offers the United Nations as a convening platform where key stakeholders from both developing and developed countries can mobilize bold commitments, foster new public-private partnerships, and leverage the significant investments needed to make the transformative changes needed in the world's energy systems. The global action agenda recommends 11 action areas to help focus efforts and mobilize commitments towards the three main objectives. Each of the action areas puts forward a number of high-impact opportunities around which Governments, business and civil society can rally.

31. In June 2012, the United Nations Conference on Sustainable Development provided an extraordinary opportunity for government leaders, civil society, communities and the private sector to define strong and decisive commitments to mobilize support to achieve the goal of sustainable energy for all by 2030. Over 100 concrete commitments and actions were announced to support the Secretary-General's initiative. Over 50 developing countries have engaged with the initiative, and the European Commission has set out an ambitious goal of helping to provide access to sustainable energy services to 500 million people by 2030. Key commitments were made by the private sector and civil society as well as Governments, donors, entrepreneurs, organizations, artists and individual volunteers. Businesses and investors have committed over $50 billion to achieve the objectives of the initiative. Tens of billions of dollars have been committed by other key stakeholders — Governments, multilateral development banks, and international and civil society organizations — to catalyse action in support of the initiative. More than 1 billion people will benefit from the public and private sector commitments. Most beneficiaries in developing countries will gain improved access to energy through grid extension and off-grid solutions, as well as scaled-up renewable energy sources, increased investment and improved energy policies.

32. Although the Sustainable Energy for All initiative has secured remarkable commitments, much more needs to be done to ensure their successful implementation in the next two decades. Nevertheless, by bringing all key stakeholders together to work on a common cause for the common good, the initiative provides a powerful model for the future. The initiative has also created global awareness of the importance of energy for sustainable development and has brought the issue to the top of the agenda for decision makers at the national and international levels. Furthermore, the efforts so far are providing a major boost to the promotion of new and renewable sources of energy.

B. National efforts

33. Governments are using different policies for promoting research, development, demonstration, deployment and commercialization of new and renewable sources of energy. At present, at least 118 countries have renewable energy targets in place and 109 countries have policies supporting renewable energy in the power sector. Most of these efforts are coordinated at the national level. One example at the regional level is that of the European Union which aims to meet 20 per cent of its gross final energy consumption from renewable sources by 2020.

34. Many cities and local governments also have active policies, plans and targets for the promotion of renewable energy use. The policies are usually associated with climate change mitigation goals. Currently, there are many institutions encouraging cooperation among cities for the local deployment of renewable energy systems.

35. Policymakers are becoming aware of the need for closer integration of renewable energy policies with policies in other economic sectors. This results from the perceived wide range of benefits that can be derived from the use of renewable energy, including energy security, reduced import dependency, reduction of greenhouse gas emissions, job creation, rural development, energy access, improved health and prevention of loss of biodiversity.

36. Policies promoting renewable energy can be classified into (a) regulatory policies, (b) fiscal incentives, (c) public finance mechanisms and (d) climate-led policies. Regulatory policies include feed-in tariffs, quotas or portfolio standards, priority grid access, building mandates, and biofuel blending requirements. Fiscal incentives refer to tax policies and direct government payments, such as rebates and grants. Public finance includes such mechanisms as loans and guarantees. Climate-led efforts include carbon pricing mechanisms, cap and trade schemes, emission targets and others.[16]

37. Many countries are adopting a menu of policy incentives instead of a single policy approach. Policymakers realize that these incentives need to be coherent, stable and designed for the long-term in order to attract the necessary funds for the robust deployment and strong markets that ultimately will reduce the cost of renewable energy.

38. Many of these incentive policies are associated with national targets. Targets are being defined in terms of renewable shares in primary energy, final energy,

[16] Intergovernmental Panel on Climate Change, 2011, *Special Report on Renewable Energy Sources and Climate Change Mitigation*; and REN21, *Renewables 2012: Global Status Report*.

electricity generation and electric capacity. Most targets are defined for shares of electricity generation and typically aim at a target of between 10 and 30 per cent of renewable energy in total electricity generation within one or two decades. More specific targets are also being defined in terms of various technologies.

39. Some countries have been very successful in the promotion of renewable energy through the use of coherent and stable policies. Germany, with a strong policy of feed-in tariffs supporting investments in wind, solar and biomass, has been able to sustain an accelerated growth in the use of renewable energy. In 2011, there was a sharp increase in the deployment of small-scale solar projects to about 7.5 GW of new solar capacity.

40. China is leading the world in installed new renewable energy capacity with an annual five-year growth rate during 2006-2011 of 93 per cent. A combination of national clean energy policies, including feed-in tariffs for wind and subsidies for rooftop and building integrated photovoltaic solar, has been very successful. China is also leading in the manufacture of wind turbines and solar modules.

41. Brazil is using electricity generation subsidies and preferential loans to provide incentives for the use of wind, small hydropower and biomass. Its key renewable energy sectors include ethanol for transport, with a production of 36 billion litres annually, and biomass electric capacity of about 8.7 GW. Brazil has committed $4.3 billion to achieving full national energy access by 2014, and is planning to invest a total of $235 billion over 10 years in renewable energy, mainly in hydropower and biofuels but also in biomass and wind.

42. India is using different policy instruments to promote renewable energy, including feed-in tariffs for wind and solar, accelerated depreciation for small hydropower and biomass, and preferential tax rates for other renewable energy projects. Its new renewable power capacity now totals 22.4 GW and is based on biomass, small hydropower and solar.

43. In 2011 and 2012, policy support for renewable energy in some countries was stimulated by the Secretary-General's initiative "Sustainable Energy for All". At the United Nations Conference on Sustainable Development, many countries announced or confirmed their partnership in the initiative and have initiated or developed national energy action plans which include programmes to increase the use of renewable energy. In addition, 20 small island developing States announced switching to renewable energy and reducing dependency on fossil fuels.

44. Norway announced a new commitment of about $140 million over five years to support energy access in some African countries. The financial support will help scale up access to sustainable energy in rural areas of Ethiopia, to replace kerosene lamps with solar alternatives in Kenya, and to develop a strategic energy and climate plan for Liberia.

45. The United States Government plans to provide $2 billion in grants, loans and loan guarantees for policy and regulatory development, public-private energy technology partnerships, and loans and guarantees to leverage private investment in clean energy technology.

46. There are important national initiatives to provide efficient biomass cookstoves and other renewable technologies to households around the world. For example, India is currently planning the roll out of efficient renewable energy

solutions to the hundreds of millions of homes across India.[17] Other countries, such as China, Mexico, Ethiopia and Nepal, are also planning national initiatives to bring cleaner renewable energy to homes.[18]

C. International institutional efforts

47. Organizations of the United Nations system continue to provide support for the promotion and expansion of new and renewable sources of energy in developing countries. Efforts during 2011 and 2012 have brought attention and awareness in particular to the important issue of universal energy access, energy efficiency and the promotion of new and renewable sources of energy, in line with the objectives of the Secretary-General's initiative "Sustainable Energy for All".

48. The States parties to the United Nations Framework Convention on Climate Change have been undertaking analyses of the gaps and barriers to finance climate change technologies. A number of mechanisms and initiatives to tackle climate change have emerged, which support energy technology cooperation and promote financing for new and renewable energy. At the sixteenth session of the Conference of the Parties in 2010, the States parties agreed to establish the Technology Mechanism, which consists of the Technology Executive Committee and the Climate Technology Centre and Network. The Centre is designed to support the transfer of relevant technologies, including renewable energy technologies. Elements in the agreement reached at the 2010 Conference included a total of $30 billion in fast-track finance from industrialized countries to support climate action in the developing world up to 2012 and the intention to raise $100 billion a year by 2020. In addition, the decision was made to establish the Green Climate Fund.

49. At its seventeenth session in 2011, the Conference of the Parties agreed on the details for operationalizing the Technology Mechanism. Agreement was also reached on the governing instrument of the Green Climate Fund. It is expected that both the Climate Technology Centre and Network and a possible new technology facilitation mechanism, proposed at the United Nations Conference on Sustainable Development in June 2012, will contribute to facilitating the deployment of new and renewable energy technologies.

50. The World Meteorological Organization (WMO) and the International Renewable Energy Agency (IRENA) are currently collaborating to assist the work of the Clean Energy Ministerial Working Group on a solar and wind energy atlas through the identification and facilitation of access to available data sets from WMO programmes and other initiatives involving WMO. The collaboration also includes efforts that may be launched under the Global Framework for Climate Services to support the work of IRENA on renewable energy potentials. WMO provides advice on a modern, inter-operable data management system involving archiving and data service facilities at the national, regional and global levels in support of the work of IRENA on renewable energy potentials and on assessing the possible impacts of climate variability (including extremes) and long-term climate change on the long-

[17] www.worldwatch.org/node/6328.

[18] www.niehs.nih.gov/about/od/programs/cookstoves/global_alliance_for_clean_cookstoves_fact_sheet.pdf.

term sustenance and variability of renewable energy resources. WMO also facilitates the access of IRENA to the operational climate products of its Climate Services Information System.

51. The efforts of the Food and Agriculture Organization of the United Nations (FAO) focus on the Energy-Smart Food for People multi-partner programme and on sustainable bioenergy. The multi-partner programme is a major contributor in respect of agrifood and the green economy and the Sustainable Energy for All initiative. The programme contributes by improving energy efficiency at all stages of the agrifood chain, increasing the use of renewable energy, and improving access to modern energy services through integrated food and energy production. FAO has developed and assisted the development of a number of important tools that support its objectives, including: a framework for calculating fossil fuel use in livestock systems; the UN-Energy Decision Support Tool for Sustainable Bioenergy; the Bioenergy and Food Security Analytical Framework; the Woodfuel Integrated Supply/Demand Overview Mapping; the Bioenergy and Food Security Criteria and Indicators project; and the criteria and indicators for sustainable woodfuel. Examples of FAO energy work with direct impact at the rural community level include: a manual on farm power and mechanization for small-scale farmers in sub-Saharan Africa; a project in Mozambique that showed that small-scale irrigation using solar pumps at the community level has positive impacts, improving food security and income; and a project that improved rural livelihoods through the use of biogas in the Bolivian Altiplano.

52. The United Nations Environment Programme (UNEP) has provided support to countries in promoting new and renewable sources of energy and energy efficiency measures along three main workstreams: assessments and analysis enabling informed, science-based decisions on which sustainable energy paths to follow, defined considering the country specific context; policy tools and institutional support that help to design and implement an appropriate enabling framework for the uptake of sustainable energy technologies and projects; and innovative finance and risk management that addresses specific needs to encourage the uptake of sustainable energy technologies, goods and services in developing countries.

53. The World Health Organization (WHO) is documenting access to clean and renewable energy in the health-care sector at the national level. It has also been raising awareness among countries and other stakeholders about the opportunities for renewable power in health-care facilities, as well as the substantial improvements in the provision of care and health outcomes that such renewable technologies can bring. For close to a decade, WHO has been monitoring and tracking in its global household energy database[19] household use of individual fuels, including both renewables (e.g. wood, agricultural residues, biogas and dung) and non-renewables (e.g. natural gas and liquefied petroleum gas). This database is an important information resource for the tracking and monitoring of Sustainable Energy for All targets in households. WHO is also preparing health air quality guidelines for household fuel combustion which will provide guidance on safe technologies using renewable energy (e.g. advanced combustion stoves) to policymakers, which will serve as a basis for efficiency and safety standards. WHO also provides tools to effectively monitor the air quality and health impacts of renewable energy technologies in the home.

[19] www.who.int/indoorair/health_impacts/he_database/en/index.html.

54. The Economic Commission for Europe (ECE) has developed the renewable energy strategy, designed to promote investment climates for renewable energy technologies, for submission to national and regional authorities in the countries of the Commonwealth of Independent States. Two studies prepared recently by ECE provide analysis relevant for the promotion of renewable energy sources: *Financing Global Climate Change Mitigation*,[20] and *Regional Analysis for Policy Reforms to Promote Energy Efficiency and Renewable Energy Investments*.[21]

55. The Economic and Social Commission for Asia and the Pacific (ESCAP) is developing a project on strengthening South-South cooperation to increase the affordability of sustainable energy options in Asia and the Pacific. The project will address the affordability of sustainable energy options through the promotion of innovative business models to enhance local production, provisioning capacity and affordability of energy products in developing countries. Also, ESCAP is implementing a project, in cooperation with the International Fund for Agricultural Development, to widen access to modern energy services in rural areas using its Pro-Poor Public-Private Partnership model.

56. The Department of Economic and Social Affairs of the United Nations Secretariat is leading and coordinating a public-private partnership initiative, Minimum Electricity Access (Min-E Access), which supports the electrification of rural isolated communities in Africa, Asia and Latin America.

57. International organizations outside the United Nations system have also announced initiatives that support sustainable energy and renewable energy technologies. For example, the European Union announced the "Energizing Development" initiative which will provide access to sustainable energy services to 500 million people by 2030. The initiative includes the creation of a technical assistance facility supported by approximately $63 million in funding over the next two years.

International finance institutions

58. International financial institutions continue to play an important role in mobilizing resources for the promotion of new and renewable energy. Their efforts are now being assessed within the framework of the Secretary-General's initiative "Sustainable Energy for All". Multilateral development banks are committing more than $30 billion towards achieving the three goals of the initiative.

59. The World Bank Group has committed to doubling the leverage of its energy portfolio by mobilizing private and public contributions to its supported projects, as well as supportive policies to expand energy access, renewable energy and energy efficiency. The World Bank and the International Finance Corporation are planning to expand existing programmes, such as Lighting Africa which aims to provide lighting to 70 million low-income households by 2020. The World Bank is also undertaking new initiatives, such as the mapping of renewable energy resources in cooperation with the Energy Sector Management Assistance Programme.

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[20] ECE Energy Series No. 37 (ECE/ENERGY/81). Available from http://ynccf.net/pdf/Climate_Finanace/GEE21_GlobalClimateChangeMitigation_ESE37.pdf.

[21] Available from www.unece.org/fileadmin/DAM/energy/se/pdfs/eneff/eneff_pub/EE21_FEEI_RegAnl_Final_Report.pdf.

60. Regional development banks are also playing a crucial role in promoting new and renewable sources of energy. The African Development Bank will invest $20 billion in energy by 2030. It is expected that this commitment will draw an additional $80 billion by partnering with public and private enterprises. Its investments will range from regional projects that benefit multiple countries to small- and medium-scale energy projects that increase access to electricity in rural regions, including through its Sustainable Energy Fund for Africa. The European Bank for Reconstruction and Development has committed $8 billion in energy efficiency projects in Eastern Europe and Central Asia for the next three years.

61. The Global Environment Facility (GEF) has invested over $1.2 billion in more than 200 renewable energy projects in almost 100 developing countries and economies in transition. These investments have been augmented by an additional $8.3 billion in co-financing. In 2010, GEF received a record finance boost from 30 donor countries of $4.25 billion for climate change adaptation and mitigation in the next four years. These initiatives have helped GEF become the largest public sector mechanism for the transfer of renewable energy technology, with investments that have contributed to the installation of more than 3 GW electric capacity and 2.8 GW of thermal capacity based on renewable energy.

Other institutional arrangements

62. An important international institution promoting renewable energy is IRENA, which was established in 2009. IRENA has 85 members and 70 signatories and/or countries processing applications for membership, a total of 155 countries. Its mandate promotes the widespread and increased adoption and sustainable use of all forms of renewable energy. IRENA will facilitate access to all relevant renewable energy information, including technical, economic and renewable resource potential data. IRENA will share experience on best practices and lessons learned regarding policy frameworks, capacity-building projects, available finance mechanisms and renewable energy-related energy efficiency measures. Abu Dhabi has been designated as the location for the interim headquarters of IRENA.

63. During 2011 and 2012, IRENA made progress in understanding the political, economic, policy and regulatory environment in which renewable energy competes. Its 2012 work programme includes three subprogrammes: (a) knowledge management and technology cooperation; (b) policy advisory services and capacity-building; and (c) innovation and technology. The Abu Dhabi Fund for Development has made available US$350 million in concessional funding over the next seven years for innovative renewable energy projects approved by IRENA.

D. Renewable energy for rural isolated communities

64. Although considerable progress has been made in renewable energy technology development and transfer, investment and policy implementation, much more is needed to increase the contribution of renewable sources of energy to rural isolated communities where there may be no other sustainable energy option. Isolated rural communities represent, in most cases, the poorest segment of the population. It is estimated that about 84 per cent of the people without access to modern energy services live in rural areas, still use traditional biomass and lack access to electricity. Many rural areas are very isolated and require decentralized systems.

65. Until recently, almost all rural distributed renewable energy technologies were still too expensive even though they have been recognized as the most sustainable options in some areas. In the past two years, systems and products have been specifically designed to address the needs of the poorest segment of the population, and at an affordable cost. Nevertheless, more support is necessary for capacity-building and technical cooperation programmes that will allow the creation of stable markets for new and renewable sources of energy for isolated rural communities.

66. Specific inexpensive products and systems for households, local industries and services should continue to be designed, developed and customized for markets in the communities with the lowest incomes. The systems and products should be reliable and affordable and must respond to specific needs and practical applications, in accordance with local traditions and lifestyles.

67. Affordability is a critical issue insofar as the capital cost necessary to acquire and install the systems, and their corresponding operating and maintenance costs. The Sustainable Energy for All initiative, with its goal of universal access by 2030, has captured the attention of many stakeholders, including donors, financial institutions and partnerships. The ongoing and announced efforts hold the potential to attract the critical international research and development and innovation support needed to make the systems more efficient, practical and affordable. Partnerships being formed at the international and national levels may provide funds and subsidies to lower the capital costs of the systems, ensuring their affordability at the lowest income levels. Policymakers are also designing and implementing policies in the form of regulations, fiscal incentives and public finance mechanisms that will allow affordable systems.

68. Financial instruments, such as microfinance initiatives and other innovative mechanisms, can be made available at the national level so that renewable energy technologies remain below a cost threshold and can be afforded by people with the lowest incomes.

69. Major population health gains can be expected from the use of efficient and clean renewable fuels in isolated rural settings. In some countries, over 95 per cent of rural households rely on the inefficient use of traditional biomass fuels to meet their most basic energy needs. Similarly, health facilities in rural and remote areas of developing countries are forced to provide vital medical services with little or no power. Efficient renewable energy technologies for rural health-care facilities and households can provide a reliable source of clean and sustainable energy that can improve the lives of isolated populations.

70. Household biogas digesters with latrine attachments have provided households in Nepal with a clean and renewable source of energy for cooking and heating, as well as access to improved sanitation.[22] The use of solar home systems has replaced polluting and health-damaging kerosene lamps in rural households in countries such as Viet Nam. Small off-grid installations of solar panels have made rural health-care facilities energy self-sufficient and have built their resilience for emergency services in a cost-effective way.[23] Solar suitcases from the non-profit organization

[22] WHO *Health in the Green Economy* series, "Household energy sector in developing countries". Available from www.who.int/hia/hgebrief_henergy.pdf.

[23] Ibid., "Health care facilities: preliminary findings — initial review". Available from www.who.int/hia/hgebrief_health.pdf.

WE CARE Solar are economical renewable power units that provide health workers with highly efficient medical light and a power source for medical devices and mobile communication.[24]

71. It is possible to escape the vicious cycle of poverty where people have access to the sustainable energy necessary to conduct all types of productive activities. Universal energy access will help about 1 billion people in rural areas in developing countries to move from the darkness and drudgery which affect them on a daily basis. Without a major change in the current trend, by 2030 the number of people without access will still be close to 900 million, 3 billion will still cook with traditional fuels and 30 million people will have died of smoke-related diseases.[25]

E. Renewable energy in small island developing States

72. Most small island developing States are highly dependent on imported oil and other fossil fuels for transport and electricity generation. Many of these States are also highly exposed to the environmental impacts associated with fossil fuel consumption, such as oil spills, sea-level rise and increased strength and frequency of hurricanes. Transitioning from fossil fuels to renewable resources not only alleviates these issues by increasing energy security but can also create local industries and opportunities to strengthen their economies.

73. Many small island developing States consider oil dependency a major source of vulnerability as they need to divert scarce financial resources to cover fuel imports instead of using those resources to promote sustainable development and poverty eradication. Nevertheless, many small island developing States have ample renewable energy resources, such as solar, wind, geothermal and ocean potential, which can be used effectively to meet their energy demand.

74. In 2012, States members of the Alliance of Small Island States adopted the Barbados Declaration on Achieving Sustainable Energy for All in Small Island Developing States, which called for universal access to modern and affordable renewable energy services while protecting the environment, ending poverty and creating new opportunities for economic growth. The Declaration includes the voluntary commitments of 20 small island developing States to take action towards providing universal access to energy, switching to renewable energy and reducing dependency on fossil fuels.

75. Examples of the above-mentioned commitments include: the goal of Maldives of achieving carbon neutrality by 2020; the aim of the Marshall Islands to electrify all urban households and 95 per cent of rural outer atoll households by 2015; the commitment by Mauritius to increase the share of renewable energy to 35 per cent or more by 2025; and the goal of Seychelles of producing 15 per cent of its energy supply from renewable sources by 2030.

76. At the 2012 United Nations Conference on Sustainable Development, Aruba announced its transition to 100 per cent renewable energy with the support of the Carbon War Room initiative. Already 20 per cent of the country's energy derives

[24] http://wecaresolar.org/solutions/solar-suitcase/.

[25] Practical Action, *Poor People's Energy Outlook 2012: Energy for Earning a Living* (Rugby, United Kingdom of Great Britain and Northern Ireland, Practical Action Publishing, 2012).

from wind power and there are several solar projects under development. The Smart Island Economies programme of the Carbon War Room, also launched at the Conference, aims to develop a model for a low carbon implementation plan and replicate it across other Caribbean and Pacific islands that may wish to take that pathway.

77. Grenada announced at the Conference a plan for increasing the use of renewable energy as a full replacement for fossil fuels by 2030. The initiative is being undertaken with international organizations, including the Carbon War Room. Grenada wants to depend on renewable energy to meet 100 per cent of its primary energy demand for electricity generation and for transport.

IV. Conclusions

78. **The accelerated deployment of renewable energy technologies over the past decade indicates their potential for playing a significant role in the future global energy system. Record investments continue to be made by countries to propel innovation, development and commercialization of these technologies. However, the international economic crisis and changing policy environments in some countries are creating new uncertainties and challenges when much more cooperation and action are needed to increase substantially the contribution of these technologies to the global energy system.**

79. **The boom in the growth of the renewable energy industry has not been balanced. Most of the growth is taking place in developed countries and in some developing countries with large emerging economies. Many poor countries with large rural populations have seen only relatively low growth in the use and commercialization of renewable energy technologies.**

80. **New and renewable sources of energy, such as onshore wind, geothermal, small hydropower, biomass and solar photovoltaic, are becoming competitive in some regions. Others are still too expensive but their costs are dropping rapidly, including the costs of some rural off-grid renewable energy technologies.**

81. **The Secretary-General's initiative "Sustainable Energy for All" has already increased global awareness of the importance of energy for sustainable development and has brought the issue to the top of the agenda for decision makers at the national and international levels. By bringing together all key stakeholders to work on a common cause for the common good, the initiative provides a powerful model for the future. The remarkable commitments made in 2011 and 2012 and at the United Nations Conference on Sustainable Development by leaders from government, civil society, communities and the private sector are already making the International Year of Sustainable Energy for All a success by promising programmes and actions for the long-term expansion of the development and use of renewable energy technologies throughout the world. The commitments support the objectives of the initiative of the Secretary-General and represent concrete steps towards the needed transformation of the global energy system.**

82. **Although much of the world is facing major financial austerity programmes, coherent and stable national policies supporting renewable**

energy should remain in place, be expanded to other countries and extended for a considerable number of additional years. Market mechanisms and investment in research, development and deployment are necessary to ensure: (a) a further reduction in the cost of technologies; (b) the establishment of secure and stable markets; and (c) progress in the transformation of the global energy system towards low-carbon economies.

83. **The main motivations for a strong deployment of new and renewable sources of energy in most developing countries is to guarantee access to modern energy services to everyone and to satisfy expected rapid increases in energy demand while addressing the global challenge of climate change. Such access is seen as indispensable to accelerating the movement towards green economies within the context of poverty eradication and sustainable development. Affordable and decentralized systems are major incentives for these countries, since their rural populations are the most affected.**

84. **Science-based assessments and analysis, policy support and innovative finance and risk mitigation mechanisms are critical to encouraging the uptake of renewable energy and energy efficiency technologies, which in turn is critical to achieving the three goals of the Sustainable Energy for All initiative.**